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23 are from New York; of 18 chemicals, all are from New York; of 23 miscellaneous, 12 are from New York; of a total of 371 quotations, 56 are from Chicago and 132 from New York. Of course New York and Chicago are the largest markets in the country, and the trade journals and selling agencies are concentrated in these great centers; but it is obvious that prices to be representative should be scattered more widely. This means expending more money than Congress appropriates to the Bureau of Labor Statistics.

In my view the best way to achieve the "best index number" is first, to secure more trustworthy and more representative prices from (1) *producers* and (2) *jobbers* and *wholesalers*, and secondly, to obtain more accurate statistics and estimates of quantities of goods produced, imported, exported, and consumed. It is especially necessary that the estimates made by me in 1914 of the quantities of goods of various kinds entering into *exchange* be carefully checked and revised in the light of more recent and more detailed information. It is desirable that several different kinds of index numbers be prepared by the federal agency having in charge the collection of producers', jobbers', and wholesalers' prices and the compilation therefrom of price indexes. Much more time and effort should be devoted to the subject of producers' and wholesale prices than has been devoted to them in the past. When the quantities and the prices are thoroughly satisfactory I think it will make but little difference what mathematical formula is used in calculating the index numbers.

THE BUSINESS INDICES OF THE *FRANKFURTER ZEITUNG*

It has long since been the policy of the *Frankfurter Zeitung* to publish original statistics with regard to economic conditions in Germany. These statistics are of particular interest at the present time because of the chaotic condition of the German credit and currency situation.

The most interesting of the statistical series which are now compiled and published by this journal are its index numbers on wholesale commodity prices, securities' prices, wages per hour in Frankfurt, and foreign exchange values, its compilations of bankruptcies, and its compilation of securities issued in Germany. All these statistics appear in the current numbers of the paper. The index of securities prices is published weekly; the wholesale price index and the statement of securities issued appear at the first of each month; the bankruptcy figures are published quarterly, while the figures on wages have appeared only once (in the second edition of May 22, 1921), and the foreign exchange figures only once (on February 26, 1921). The index numbers among these series have also been published from time to time within the last six months in pamphlet form called, in its first edition, "Die Indexziffern der Frankfurter Zeitung," and thereafter "Die

Indexzahlen der Frankfurter Zeitung." Each edition bears upon its cover the name of Ernst Kahn, and opens with an introduction by him.

The method by which these indices are constructed is very simple. In each case the index represents an unweighted arithmetic average of relatives, using quotations as of January 1, 1920, as a base. In introducing the wholesale price index number, the author says:

> "Unfortunately up to this time Germany has lacked a good wholesale price index. We hereby attempt to give one. In the construction of the commodity price index of the *Frankfurter Zeitung*, the investigations which Professor Irving Fisher sets forth in his two great books, 'The Purchasing Power of Money' (which was published in German by G. Reimer [Berlin] in 1916) and his newest work 'Stabilizing the Dollar' have been taken into account along with our own information on the subject. The layman will demand as the first requisite for a good commodity index number that in the assembling of the quotations each commodity shall be valued or weighted according to its importance in industry. Fisher's investigations show that this is not necessary. The following graph taken from Fisher's work makes that evident; we see that computation with or without the use of quantity weights gives parallel curves." (At this point the graph, which appears on page 3 of "Stabilizing the Dollar," is reproduced.) "It would take us too far afield to set forth here the theoretical grounds of this noteworthy discovery, but these investigations of Fisher's have given us the courage to attempt to carry out our long cherished desire to compute a commodity index number. The difficult question of placing the individual commodities according to their importance had always kept us, before this, from undertaking the task."

The commodity index of the *Frankfurter Zeitung* is, however, roughly weighted by the choice of commodities included. In the index as it now stands* there are seven quotations for chemicals, three quotations for coal, and five for iron and steel products. Raw cotton, cotton yarn, and cotton cloth are all represented, as are hides, leather and shoes; flax and linen yarn are both included, and raw jute and jute bagging, but wool and silk are represented by only one quotation apiece.

This index contains 77 commodities, divided into four groups as follows:

Group I. Wheat, rye, oats, barley, corn, potatoes, beans, peas, lentils, rice, eggs, meat, lard, margarine, butter, milk, condensed milk, powdered cocoa, coffee, sugar, beer, tobacco, hay, straw, hops, wine.

Group II. Raw cotton, scoured South-German sheep's wool, silk yarn (organzine), cotton yarn, cotton cloth, artificial silk, flax, linen yarn, raw jute, jute bagging, twine, hides, leather, shoes, rubber.

Group III. Non-coking bituminous coal, coking coal, foundry coke, Rhenish lignite, machine pressed peat, iron ore, pig iron, rolled plates, steel scrap, iron bars, copper, tin, zinc, lead, aluminium, nickel, silver, gold.

Group IV. Machine oil (refined), petroleum, benzine, benzol, newsprint paper, cement, bricks, salts of potash, sulphate of ammonia, lime nitrogen, kainite, brown leather dye, alcohol, timber, firewood, calcium carbide, saltpetre, coal tar oil.

The "peace index" (*i. e.*, the index number applying to the middle of 1914) and that for January 1, 1920, are the only ones, however, which include all the commodities noted. In every other month it has been impossible to get a complete list of quotations. It is, in fact, remarkable, considering the chaotic state of German prices, that omissions have not been more numerous.

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* See "Die Indexzahlen der Frankfurter Zeitung," 4th edition, dated May 17, 1921.

WHOLESALE PRICE INDEX OF THE *FRANKFURTER ZEITUNG*

	Foods, etc.	Textiles, leather, etc.	Minerals	Miscellaneous	All commodities
Peace index	11.38	3.67	7.15	12.0	9.23
1920					
January 1	100	100	100	100	100
February 1	119	153	145	123	131
March 1	126	165	163	147	147
April 1	135	151	135	170	146
May 1	134	119	133	170	156
June 1	128	98	110	197	134
July 1	146	94	111	195	136
August 1	149	97	112	194	141
September 1	150	103	118	193	144
October 1	153	108	124	191	146
November 1	165	111	120	199	152
December 1	177	99	117	195	153
1921					
January 8	154	97	120	189	148
February 5	144	92	113	183	136
March 5	137	87	111	182	131
April 2	136	79	115	180	130.1
May 7	133	78	112	194	131.8
June 4	127	70	109	196	128
July 2	144.5	79	115.3	190.6	135.4

The statistics used in the index number of wages per hour paid in Frankfurt represent 23 different trades. It was possible, however, to obtain comparable rates in 1914 for only 9 of these trades, so that the index number uses January 1, 1920, as a base, and gives no figures for 1914. It is computed by averaging the monthly relatives obtained for each industry. The figures do not take into account unemployment and hours of labor in the various industries represented and do not, therefore, give any indication of the actual earnings of wage-workers in Frankfurt.

The following table presents the wage index of the *Frankfurter Zeitung:*

FRANKFURT-AM-MAIN

	Index number of hourly wages
1920	
First of January	100
February	112
March	122
April	146
May	168
June	169
July	184
August	186
September	186
October	188
November	198
December	200
1921	
Beginning of the year	203
First of May	219

The following table gives the index numbers for wages in the industries for which 1914 rates could be obtained:

RELATIVE WAGES PER HOUR IN FRANKFURT-AM-MAIN*
(JANUARY 1, 1920 = 100)

Industry	1914	January 1, 1920	July 1, 1920	Beginning of 1921	May 1, 1921
Building	22	100	195	226	233
Metallurgical	22	100	206	230	230
Soap	16	100	190	208	221
Food	16	100	169	211	257
Shoe	22	100	157	174	222
Decorating	22	100	203	242	265
Rubber	21	100	238	255	272
Chemical	22	100	250	279	291
Mining	17	100	159	180	200

* In the majority of these cases the increase in wages seems to have been approximately the same as the increase in the cost of living. According to the cost of living index for Frankfurt compiled by Dr. Elsas, living costs in that city have risen from 26.5 on January 1, 1914, to 280 in May, 1921 (using April 1, 1919, as 100). In dealing with these figures, it should be remembered that living costs have been kept as low as they are by the government regulation of rents and of the prices of some foodstuffs.

It seems regrettable that none of the index numbers of the *Frankfurter Zeitung* is weighted. It is particularly unfortunate in the case of the index of foreign exchange values, where an unweighted arithmetic average is especially unreliable. In this case, however, it would be particularly difficult, as Herr Kahn points out, to obtain the data necessary for the compilation of weights, since the most recent statistics giving German trade by countries apply to the period from January through August, 1920. He therefore heads his paragraphs explaining this index, "Der Versuch eines Valutenindex" ("A Tentative Foreign Exchange Index"). The quotations included are those on eleven countries: the United States, England, France, Holland, Switzerland, Sweden (as the greatest of the Scandinavian countries), Italy, Spain, Belgium, German-Austria (as the representative of the former Austro-Hungarian territory), and Roumania (as the country in the Balkans of the greatest importance to Germany at the present time). The following table gives the figures arrived at by averaging the relatives of quotations on these countries, using the par value of the mark as 100:

GERMAN FOREIGN EXCHANGE INDEX
(Par value of the mark = 100)

1920	
January	13.4
April	10.1
May	7.3
June	18.3
July	18.2
August	17.2
September	15.5
October	13.1
November	10.5
December	11.7
1921	
January	11.1
February	11.6
March	12.2
April	11.9
May	10.8

The index number of securities prices (the Bourse index) contains quotations of 25 shares and 10 bonds. Its fluctuations are summarized in the following table:

INDEX NUMBERS OF SECURITIES PRICES

	10 Bonds	25 Shares	Total
1919			
September 1	97	79	87
1920			
January 1	100	100	100
February 1	120	139	*137
March 1	145	*158	*157
May 3	114	*135	133
June 1	105	110	109
July 1	106	119	117
August 2	106	144	140
September 4	*122	152	*148
October 2	122	*165	160
November 6	143	*181	177
December 4	136	184	178
1921			
January 8	132	*202	194
February 5	121	165	159
March 5	118	*158	153
April 2	117	169	163
May 7	120.5	*166	*161
June 4	120.6	172	166
July 2	125	188	181

* Corrected in accordance with the aggregate prices published by the *Frankfurter Zeitung*. In these cases the index number published does not agree with the corresponding absolute figures. The deviations are in most cases very slight.

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Federal Reserve Board

ON PROFESSOR MORITZ' METHOD FOR COMPUTING FREQUENCY PERCENTAGES

In a recent article[*] Professor Moritz sets forth a new method for computing frequency percentages. The same method may be applied in computing the percentages that the frequencies are of N. In certain psychological experiments each of N individuals attempts all of a number of problems, and the frequencies of success or failure for each problem are

$$f_1, f_2, f_3, \quad . \quad . \quad . \quad , f_n.$$

It is required to compute the percentages

$$P_k = 100 f_k / N, \; k = 1, 2, 3, \quad . \quad . \quad . \quad , n.$$

The two steps in the method analogous to those of Professor Moritz will be:

(1) Replace the frequencies f_k by proportional numbers f'_k, the factor of proportionality being N'/N, where N' approximates 100.

(2) Distribute the difference $D = 100 - N'$ over the numbers f'_k in accordance with the formula $\Delta f'_k = f'_k \, . \, D/100$, where $\Delta f'_k$ is that portion of D which falls to f'_k.

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[*] "On a New Method of Computing Frequency Percentages," QUARTERLY PUBLICATIONS OF AMERICAN STATISTICAL ASSOCIATION, March, 1921.